

[0023] (k) to provide a device that is usable in and useful for recreation, industry, emergency, rescue, manufacturing, military, and any other application relating to or utilizing rope, cable, string, or fiber tension.

[0024] Still further objects and advantages are to provide a rope or cable pulling device that is as easy to use as a cordless power drill, that can be used in any orientation, that can be easily clipped to either a climbing harness or Swiss seat, that can be just as easily attached to a grounded object to act as a winch, that is powered by a portable rotational motor, and that is lightweight easy to manufacture.

SUMMARY OF THE INVENTION

[0025] The invention provides a rope or cable pulling device that preferably accomplishes one or more of the objects of the invention or solves at least one of the problems described above.

[0026] In a first aspect, a device of the invention includes a powered rotational motor having an output and a rotating drum connected to the output of said rotational motor where the rotating drum has a longitudinal axis and a circumference. The device further includes a guide mechanism for guiding the resilient elongate element onto, around at least a portion of the circumference of, and off of the rotating drum. When the powered rotational motor turns the rotating drum, the rotating drum thereby continuously pulls the resilient elongate element through the device.

[0027] A device of the invention can conveniently be configured as a portable hand-held device, and in particular, can be configured as a portable rope ascender. Further aspects of the invention will become clear from the detailed description below, and in particular, from the attached claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] **FIG. 1** provides a diagrammatic view of a device of the invention;

[0029] **FIG. 2** shows an isometric view of an embodiment of the invention, showing a motor, batteries, handle, rotating drum, guiding rollers, safety clamp, tensioning roller and clip-in attachment point;

[0030] **FIG. 3** shows a front view of the device of **FIG. 2**;

[0031] **FIG. 4** shows a side view of the device of **FIG. 2**;

[0032] **FIG. 5** shows a close-up profile and isometric view of the rotating drum of the device of **FIG. 2**;

[0033] **FIG. 6** shows an isometric view of an alternative embodiment of the invention;

[0034] **FIG. 7** shows a front view of the embodiment of **FIG. 6**;

[0035] **FIG. 8** shows a side view of the embodiment of **FIG. 6**;

[0036] **FIG. 9** illustrates a further embodiment of the invention;

[0037] **FIG. 10** shows isometric view of the embodiment of **FIG. 9**; and

[0038] **FIG. 11** shows a side view of the embodiment of **FIG. 9**.

DETAILED DESCRIPTION

[0039] Referring now to **FIG. 1**, a device **100** of the invention for pulling a resilient elongate element such as a cable or a rope **114** is illustrated diagrammatically. The device includes a rotational motor **102** from which the pulling motion of the device is derived. A number of different types of motors, such as two or four stroke internal combustion engines, or ac or dc powered electric motors, could be employed to provide the rotational motion desired for pulling the rope or cable. A motor power source **104** can also be included that is appropriate to the rotational motor used, such as gasoline or other petroleum products, a fuel cell, or electrical energy supplied in ac (such as from a power outlet in a typical building) or dc (such as from a battery) form. In one preferred embodiment, the rotational motor is a dc electric motor and the motor power source is one or more rechargeable lithium ion batteries.

[0040] The rotational motor can also have speed control **106** and/or a gearbox **108** associated with it to control the speed and torque applied by the rotational motor to the task of pulling a rope. These elements can be integrated into a single, controllable, motor module, be provided as separate modules, or be provided in some combination thereof. In one embodiment, speed control elements can be provided integrally with a dc rotational motor, while a separate, modular gearbox is provided so that the gearing, and thus the speed and torque characteristics of the rope pulling device, can be altered as desired by swapping the gears.

[0041] A rotating drum **110** is connected to the rotational motor, either directly or through a gearbox (if one is present). It is the rotating drum, generally in the manner of a capstan, that applies the pulling force to the rope that is pulled through the device **116**. In a preferred embodiment of the invention, the rotating drum provides anisotropic friction gripping **112** of the rope. In particular, in a preferred embodiment, the surface of the rotating drum has been treated so that large friction forces are created in the general direction of the pulling of the rope (substantially around the circumference of the drum), and smaller friction forces are created longitudinally along the drum so that the rope can slide along the length of the drum with relative ease.

[0042] In the alternative embodiment of the rope interaction assembly depicted in **FIGS. 9, 10** and **11**, the rotating drum is split into sections. These sections rotate between stationary sections which contain guide rollers that move the rope from one wrap to the next. This embodiment also makes use of the splined drum to exploit the anisotropic friction when advancing the rope from each wrap to the next.

[0043] A rope or cable is also referenced in **FIG. 1**. The device of the present invention is intended to be able to be able to pull any elongate resilient element that can withstand a tension. Cables and ropes are the most common of these, but the invention is not meant to be limited by the reference to ropes or cables.

[0044] A preferred embodiment of a rope pulling device **100** of the invention is shown in **FIGS. 2** (Isometric view), **3** (front view) and **4** (side view). In this embodiment, rotational motor **4** applies rotational power to rotating drum **8** via gearbox **6**. Batteries **3** apply necessary power to motor **4**. A rope handling mechanism guides a rope to and from the rotating drum. In particular, rope **21** enters through rope